

CLAIMS

We claim:

1. A method for applying at least one coating on at least one substrate,
5 said method comprising:
 presenting at least one of said substrate to a chamber; said chamber having a
down stream pressure, P_c , with an operating range from about 10^{-4} to about 10^3 Torr;
 presenting at least one evaporant source to said chamber;
 presenting primary carrier gas streams comprised of gas molecules to said
10 chamber;
 impinging at least one said evaporant source with at least one energetic beam
in said chamber to generate an evaporated vapor flux comprised of evaporant
molecules;
 said substrate having a distal end and a proximal end defining a longitudinal
15 section there between, said substrate having an interior cavity; and
 said primary carrier gas streams deflecting at least a portion of at least one of
said generated evaporated vapor flux by said primary carrier gas streams into said
interior cavity of said substrate thereby coating at least a portion of interior of said
longitudinal section.
20
2. The method of claim 1, further comprising:
 a first nozzle, wherein said primary carrier gas streams is generated from said
first nozzle and said at least one evaporant source is disposed in said first nozzle.
- 25 3. The method of claim 1, further comprising:
 a first nozzle, wherein said primary carrier gas streams is generated from said
first nozzle and said at least one evaporant source is disposed in proximity to said first
nozzle.
- 30 4. The method of claim 1, wherein said evaporant molecules having a
Knudsen number equal to or less than 1.

5. The method of claim 4, wherein
said Knudsen number is defined by the ratio:
mean free path, λ , / length of said at least portion of said coating.
- 5 6. The method of claim 1, wherein said energetic beam comprises at least
one of electron beam source, laser source, heat source, ion bombardment source,
highly focused incoherent light source, microwave, radio frequency, EMF, or any
energetic beam that break chemical bonds, or any combination thereof.
- 10 7. The method of claim 1, wherein method of said coating is
accomplished with a deposition method comprising:
at least one of directed vapor deposition (DVD), evaporation (thermal, RF,
laser, or electron beam), reactive evaporation, sputtering (DC, RF, microwave and/or
magnetron), reactive sputtering, electron beam physical vapor deposition (EF-PVD),
15 ion plasma deposition (IPD), low pressure plasma spray (LPPS), high velocity oxy-
fuel (HVOF), vapor deposition, or cluster deposition.
8. The method of claim 1, wherein method of said coating is
accomplished with a directed vapor deposition (DVD).
- 20 9. The method of claim 1, wherein said primary carrier gas streams
comprise He, Ar, Ne, Kr, O₂, N₂, NH₄, CH₄, H₂, hydrocarbons, salines, and other inert
gases, or combination of at least one of He, Ar, Ne, Kr, O₂, N₂, NH₄, CH₄, H₂,
hydrocarbons, salines, and other inert gases.
- 25 10. The method of claim 1, wherein said at least one evaporant sources
comprise a material comprising:
at least one of metal, alloy, ceramic, semiconductor or polymer or any
combination thereof.
- 30 11. The method of claim 1, wherein said substrate comprises a tube.

12. The method of claim 1, wherein said substrate comprises a shape comprising at least one of: casing, cylinder, drum, basket, receptacle, bin, box, collar, hamper, well, cell, cell-case, case, shell, hoop, cover, envelope, housing, enclosure, chamber, sleeve, holder, repository, shelter, body, or bowl.

5

13. The method of claim 1, wherein said substrate comprises a housing.

14. The method of claim 1, wherein said longitudinal section comprises one or more walls.

10

15. The method of claim 14, wherein said one or more walls comprise at least one recessed area, wherein said coating covers at least a portion of the area of said at least one recessed area.

15

16. The method of claim 15, wherein said at least one recessed area comprises a groove.

20

17. The method of claim 16, wherein said groove comprises at least one of the following: ridge, trench, channel, duct, trough, perforation, indentation, slot or concave area.

25

18. The method of claim 14, wherein said one or more walls comprise at least one recessed area, wherein said coating covers the entire area of said at least one recessed area.

19. The method of claim 14, wherein said evaporated flux at least partially coats said portion of said interior of said longitudinal section on a non-line-of-sight region relative to said evaporant sources.

30

20. The method of claim 14, wherein said evaporated flux at least partially coats said portion of said interior of said longitudinal section on a limited-line-of-sight region relative to said evaporant sources.

21. The method of claim 14, wherein said evaporated flux at least partially coats said portion of said interior of said longitudinal section on a limited-line-of-sight region and a non-line-of-sight region relative to said evaporant sources.

5

22. The method of claim 1, wherein said down stream pressure, P_c , having an operating range from about 10^{-3} to about 10^{-2} Torr.

23. The method of claim 1, wherein said down stream pressure, P_c , having an operating range from about 10^{-2} to about 10 Torr.

10

24. The method of claim 1, wherein said down stream pressure, P_c , having an operating range from about 0.1 to about 1 Torr.

15

25. The method of claim 1, wherein said down stream pressure, P_c , having an operating range from about 0.05 to about 0.5 Torr.

26. The method of claim 1, wherein said down stream pressure, P_c , having an operating range from about 0.025 to about 0.3 Torr.

20

27. The method of claim 1, further comprises:
presenting a deflector member; and
said deflector member secondarily deflecting said at least a portion of said generated evaporated vapor flux that has been deflected into said interior cavity by said carrier gas streams thereby coating at least a portion of said longitudinal section, wherein said at least a portion of said longitudinal section defining a deposition zone.

25

28. The method of claim 27 wherein said deflector member comprises at least one of plate, sphere, cone, or ellipsoid, said plate, sphere, cone or ellipsoid at least partially disposed in said interior cavity of said substrate.

30

29. The method of claim 1, further comprises:

presenting a secondary carrier gas streams comprised of gas molecules in said interior cavity of said substrate, and

said secondary carrier gas streams secondarily deflecting said at least at least a portion of said generated evaporated vapor flux that has been deflected into said interior cavity by said carrier gas streams thereby coating at least a portion of said longitudinal section, wherein said at least a portion of said longitudinal section defining a deposition zone.

30. The method of claim 1, wherein said proximal end of said substrate initially being closer to said evaporant source relative to the distance of distal end to said evaporant source, said method further comprising:

moving said substrate wherein said distal end is closer to said evaporant source relative to the distance of said proximal end to said evaporant source.

31. The method of claim 30, wherein said moving said substrate comprises flipping said substrate approximately 180 degrees.

32. The method of claim 1, further comprises:

presenting a baffle member; and

said baffle member secondarily deflecting said at least a portion of said generated evaporated vapor flux that has been deflected into said interior cavity by said carrier gas streams thereby coating at least a portion of said longitudinal section, wherein said at least a portion of said longitudinal section defining a deposition zone.

33. The method of claim 32, wherein said baffle comprises a spiral member or ring member.

34. The method of claim 1, further comprises:

presenting a baffle member; and

said baffle member stagnating flow of said at least a portion of said generated evaporated vapor flux that has been deflected into said interior cavity by said carrier

gas streams thereby coating at least a portion of said longitudinal section in proximity to said baffle.

35. The method of claim 34, wherein said baffle comprises a spiral member or ring member.

36. The method of claim 1, wherein said substrate comprising an exterior side on said longitudinal section substantially opposite from the interior cavity, said method further comprises:

10 said primary carrier gas streams deflecting at least a portion of at least one of said generated evaporated vapor flux by said primary carrier gas streams to the exterior of said substrate thereby coating at least a portion of exterior side of said longitudinal section.

15 37. The method of claim 36, wherein said longitudinal section comprises one or more walls.

38. The method of claim 36, wherein said evaporated flux at least partially coats said portion of said interior and exterior of said longitudinal section on a limited-line-of-sight region and a non-line-of-sight region relative to said evaporant source.

39. The method of claim 1, further comprising:
presenting a first nozzle;
25 presenting a second nozzle, wherein a second primary carrier gas streams is generated from said second nozzle and a second said evaporant source is disposed in said second nozzle;

impinging said second evaporant source with at least one electron energetic beam in said chamber to generate a second evaporated vapor flux comprised of evaporant molecules;

30 presenting a secondary carrier gas streams comprised of gas molecules to said chamber;

said secondary carrier gas streams deflecting at least a portion of at least one of said second generated evaporated vapor wherein said secondary deflection thereby deflects said second carrier gas streams to the exterior of said substrate thereby coating at least a portion of exterior side of said longitudinal section.

5

40. The method of claim 39, wherein said primary carrier gas streams is generated from said first nozzle and said at least one evaporant source is disposed in said first nozzle.

10

41. The method of claim 1, wherein said generated vapor flux having a diameter as said generated vapor flux is deflected into said interior cavity, wherein said vapor flux diameter may be decreased by any one of the following methods:

15

- a) increasing the upstream pressure,
- b) increasing the atomic weight of said carrier gas atoms, or
- c) increasing the pressure ratio.

42. The method of claim 1, wherein said generated vapor flux having a diameter as said generated vapor flux is deflected into said interior cavity, wherein said method further comprising:

20

presenting a nozzle, wherein said carrier gas streams are generated from said nozzle and said at least one evaporant source is disposed in said nozzle, and wherein said vapor flux diameter may be decreased by decreasing the diameter of said nozzle.

25

43. The method of claim 1, wherein said vapor flux defocuses at the location in said interior cavity where said coating occurs on said at least a portion of interior of said longitudinal section.

30

44. The method of claim 43, wherein said vapor flux defocuses location defines a gas de-focus region, wherein said gas de-focus region is defined as the location in said interior cavity where said coating occurs on said at least a portion of interior of said longitudinal section.

45. The method of claim 43, wherein said vapor flux defocus location defines a gas jet focal distance, wherein said jet focal distance is defined as the distance between location of said evaporant source and location where vapor flux defocuses.

46. The method of claim 45, wherein said gas jet focal distance can be increased by increasing the gas jet pressure ratio.

47. The method of claim 46, wherein said gas jet pressure ratio is defined by the equation:

$$\frac{P_u}{P_c}$$

P_u is the upstream pressure of at least one nozzle that presents said at least one carrier gas streams to said chamber, and

P_c is the down stream pressure of said at least one chamber.

48. The method of claim 45, wherein said gas jet focal distance can be increased by increasing the upstream pressure.

49. The method of claim 45, wherein said gas jet focal distance can be increased by increasing the molecular weight of the carrier gas atoms.

50. The method of claim 45, wherein said gas jet focal distance can be increased by increasing the diameter of the diameter of nozzle opening and evaporant source rod.

51. The method of claim 45, wherein said gas jet focal distance can be increased by increasing the carrier gas stream flow rate or decreasing the pumping rate from said chamber, which both have the effect of increasing both the upstream and downstream pressures if the nozzle diameter is held constant.

52. The method of claim 45, wherein said gas jet focal distance can be decreased by decreasing the gas jet pressure ratio.

53. The method of claim 52, wherein said gas jet pressure ratio is defined
5 by the equation:

$$\frac{P_u}{P_c}$$

P_u is the upstream pressure of at least one nozzle that presents said at least one carrier gas streams to said chamber, and

P_c is the down stream pressure of said at least one chamber.

10

54. The method of claim 45, wherein said gas jet focal distance can be decreased by decreasing the upstream pressure.

55. The method of claim 45, wherein said gas jet focal distance can be
15 decreased by decreasing the molecular weight of the carrier gas atoms.

56. The method of claim 45, wherein said gas jet focal distance can be decreased by decreasing the diameter of the diameter of nozzle opening and evaporant source rod.

20

57. The method of claim 45, wherein said gas jet focal distance can be decreased by decreasing the carrier gas stream flow rate.

58. The method of claim 45, further comprising:
25 adjusting said gas focal distance N number ($N \geq 1$) of magnitudes,
wherein each said N number of magnitudes of said gas focal distance corresponds with said carrier gas streams deflecting said at least one of said evaporated vapor flux to coat X number ($X \geq 1$) of portions of said longitudinal section, each said X number of portions defining a deposition zone.

30

59. The method of claim 45, further comprising:

adjusting said gas focal distance to a first magnitude,
wherein said first magnitude of said gas focal distance corresponds with said
carrier gas streams deflecting said at least one of said evaporated vapor flux to coat a
first portion of said longitudinal section, said first portion defining a first deposition
5 zone; and

adjusting said gas focal distance to a second magnitude, and
wherein said second magnitude of said gas focal distance corresponds with
said carrier gas streams deflecting said at least one of said evaporated vapor flux to
coat a second portion of said longitudinal section, said second portion defining a
10 second deposition zone.

60. The method of claim 59, further comprising:
providing a mask disposed in the interior cavity of said substrate, said mask
disposed proximal to said longitudinal section at portions other than said first and
15 second deposition zones;
wherein said mask further defines said first and second deposition zones by
preventing said evaporated vapor flux from coating said portions other than said first
and second deposition zones.

20 61. The method of claim 59, further comprising:
adjusting said gas focal distance to a third magnitude,
wherein said third magnitude of said gas focal distance corresponds with said
carrier gas streams deflecting said at least one of said evaporated vapor flux to coat a
third portion of said longitudinal section, said third portion defining a third deposition
25 zone.

62. The method of claim 61, further comprising:
providing a mask in said interior cavity of said substrate, said mask disposed
proximal to said longitudinal section at portions corresponding to said first and second
30 deposition zones;
wherein said mask further defines said third deposition zone by preventing
said evaporated vapor flux from coating said first and second deposition zones.

63. The method of claim 45, wherein said presenting at least one evaporant source to said chamber comprises a first and second evaporant source; said impinging comprises impinging said first and second evaporant source to generate a first
5 evaporated vapor flux comprised of evaporant molecules and a second evaporated vapor flux comprised of evaporant molecules; said deflecting comprises deflecting at least a portion of said first and said second generated evaporated vapor fluxes by said primary carrier gas streams into said interior cavity, said method further comprises:

adjusting said focal distance to a first magnitude,

10 wherein said first magnitude of said gas focal distance corresponds with said carrier gas streams deflecting said first evaporated vapor flux to coat a first portion of said longitudinal section, said first portion defining a first deposition zone; and

adjusting said gas focal distance to a second magnitude,

15 wherein said second magnitudes of said gas focal distance corresponds with said carrier gas streams deflecting said second evaporated vapor flux to coat a second portion of said longitudinal section, said second portion defining a second deposition zone.

64. The method of claim 63, further comprising:

20 providing a mask disposed in the interior cavity of said substrate, said mask disposed proximal to said longitudinal section at portions other than said first and second deposition zones;

25 wherein said mask further defines said first and second deposition zones by preventing said evaporated vapor flux from coating said portions other than said first and second deposition zones .

65. The method of claim 45, wherein said presenting at least one evaporant source to said chamber comprises a first and second evaporant source; said impinging comprises impinging said first and second evaporant source to generate a first
30 evaporated vapor flux comprised of evaporant molecules and a second evaporated vapor flux comprised of evaporant molecules; said deflecting comprises deflecting at

least a portion of said first and said second generated evaporated vapor fluxes by said primary carrier gas streams into said interior cavity, said method further comprises:

adjusting said focal distance to a first magnitude,

wherein said first magnitude of said gas focal distance corresponds with said carrier gas streams deflecting said first and second evaporated vapor flux to coat a first portion of said longitudinal section, said first portion defining a first deposition zone.

66. The method of claim 65, further comprising:

providing a mask disposed in the interior cavity of said substrate, said mask disposed proximal to said longitudinal section at a portion other than said deposition zone; and

said mask further defining said deposition zone by preventing said evaporated vapor flux from coating masked portions of said longitudinal section in proximity of said mask.

67. The method of claim 65, wherein said presenting at least one evaporant source to said chamber further comprises a third evaporant source; said impinging further comprises impinging said third evaporant source to generate a third evaporated vapor flux comprised of evaporant molecules and a third evaporated vapor flux comprised of evaporant molecules; said deflecting comprises deflecting at least a portion of said third generated evaporated vapor flux by said primary carrier gas streams into said interior cavity, said method further comprises:

adjusting said gas focal distance to a third magnitude,

wherein said third magnitude of said gas focal distance corresponds with said carrier gas streams deflecting said first evaporated vapor flux to coat a third portion of said longitudinal section, said third portion defining a third deposition zone.

68. The method of claim 67, further comprising:

providing a mask in said interior cavity of said substrate, said mask disposed proximal to said longitudinal section at portions corresponding to said first and second deposition zones;

wherein said mask further defines said third deposition zone by preventing said evaporated vapor flux from coating said first and second deposition zones.

69. The method of claim 45, wherein said impinging further comprises
5 impinging said first or second evaporant sources to generate a third evaporated vapor flux comprised of evaporant molecules and a third evaporated vapor flux comprised of evaporant molecules; said deflecting comprises deflecting at least a portion of said first or second generated evaporated vapor flux by said primary carrier gas streams into said interior cavity, said method further comprises:
10 adjusting said focal distance to a third magnitude,
wherein said third magnitude of said gas focal distance corresponds with said carrier gas streams deflecting said first or second evaporated vapor flux to coat a third portion of said longitudinal section, said third portion defining a third deposition zone.

70. The method of claim 69, further comprising:
providing a mask disposed in said interior cavity of said substrate, said mask disposed proximal to said longitudinal section at portions corresponding to said first and second deposition zones;
wherein said mask further defining said third deposition zone by preventing
20 said evaporated vapor flux from coating said first and second deposition zones.

71. The method of claim 45, further comprising:
adjusting said gas focal distance to a third magnitude,
wherein said gas focal distance corresponds with said carrier gas streams
25 deflecting said first or second evaporated vapor fluxes to coat a third portion of said longitudinal section, said third portion defining a third deposition zone.

72. The method of claim 71, further comprising:
providing a mask in said interior cavity of said substrate, said mask disposed
30 proximal to said longitudinal section at portions corresponding to said first and second deposition zones;

wherein said mask further defining said third deposition zone by preventing said evaporated vapor flux from coating said first and second deposition zones.

73. The method of claim 1, further comprising:

5 a primary nozzle, wherein said primary carrier gas streams is generated from said primary nozzle; and

a secondary nozzle, wherein said secondary carrier gas streams is generated from said primary nozzle and said secondary nozzle is disposed in the interior cavity of said substrate.

10 74. The method of claim 73, wherein said substrate comprises a housing.

75. The method of claim 74, wherein said housing comprises a shape comprising at least one of: tube, casing, cylinder, drum, basket, receptacle, bin, box ,
15 collar, hamper, well, cell, cell-case, case, shell, hoop, cover, envelope, enclosure, chamber, sleeve, holder, repository, shelter, body, or bowl.

76. The method of claim 74, wherein said longitudinal section comprises one or more walls, and at least one of said one or more walls further comprising an
20 appendage extending there from,

said secondary gas secondarily deflecting said at least at least a portion of said generated evaporated vapor flux that has been deflected into said interior cavity of said substrate by said carrier gas streams thereby coating at least a portion of said appendage, wherein said at least a portion of said appendage defining an appendage
25 deposition zone.

77. The method of claim 76, wherein said appendage providing an appendage interior cavity, said appendage interior cavity in communication with said substrate interior cavity.

30 78. A method for applying at least one coating on a chamber, said method comprising:

said chamber having a down stream pressure, P_c , with an operating range from about 10^{-4} to about 10^3 Torr;

presenting at least one evaporant source to said chamber;

presenting primary carrier gas streams comprised of gas molecules to said
5 chamber,

impinging at least one said evaporant source with at least one electron energetic beam in said chamber to generate an evaporated vapor flux comprised of evaporant molecules; and

said primary carrier gas streams deflecting at least a portion of at least one of
10 said generated evaporated vapor flux, wherein said evaporated flux at least partially coats a portion of said chamber.

79. The method of claim 78, wherein said chamber is a tube.

15 80. The method of claim 79, wherein said tube comprises a shape comprising at least one of: tube, casing, cylinder, drum, basket, receptacle, bin, box, collar, hamper, well, cell, cell-case, case, shell, hoop, cover, envelope, housing, enclosure, chamber, sleeve, holder, repository, shelter, body, or bowl.

20 81. The method of claim 80, wherein said tube further comprises at least one branch.

82. The method of claim 81, wherein said evaporated flux at least partially coats a portion of said at least one branch.

25

83. The method of claims 81, further comprising:

presenting a secondary carrier gas streams comprised of gas molecules to said chamber, and

said secondary carrier gas streams deflecting at least a portion of at least one
30 of said generated evaporated vapor flux, wherein said secondarily deflected evaporated flux at least partially coats a portion of said at least one branch.

84. The method of claims 81, further comprising:
presenting a secondary carrier gas streams comprised of gas molecules to said chamber, and

said secondary carrier gas streams deflecting at least a portion of at least one
5 of said generated evaporated vapor flux that has been deflected by said primary carrier gas streams, wherein said secondarily deflected evaporated flux at least partially coats a portion of said at least one branch.

85. The method of claims 78, further comprising:
10 presenting a secondary carrier gas streams comprised of gas molecules to said chamber, and

said secondary carrier gas streams deflecting at least a portion of at least one
of said generated evaporated vapor flux, wherein said secondarily deflected evaporated flux at least partially coats a portion of said chamber.

15 86. The method of claims 78, further comprising:
presenting a secondary carrier gas streams comprised of gas molecules to said chamber, and

said secondary carrier gas streams deflecting at least a portion of at least one
20 of said generated evaporated vapor flux that has been deflected by said primary carrier gas streams, wherein said secondarily deflected evaporated flux at least partially coats a portion of said chamber.

87. The method of claim 78, further comprising:
25 providing a magnetic field or electromagnetic field that manipulates said electronic energetic beam in said chamber.

88. The method of claim 87, wherein said magnetic field provided by a magnetic device or electromagnetic device.

30

89. The method of claim 88, wherein said magnetic device or electromagnetic device disposed inside or outside said chamber or located both inside and outside said chamber.

5 90. An apparatus for applying at least one coating on at least one substrate, said apparatus comprising:

a chamber; said chamber having a down stream pressure, P_c , with an operating range from about 10^{-4} to about 10^3 Torr, wherein said at least one substrate is presented to said chamber, said substrate having a distal end and a proximal end
10 defining a longitudinal section there between, said substrate having an interior cavity;
at least one evaporant source disposed in said chamber;

primary carrier gas streams comprised of gas molecules provided in said chamber,

at least one energetic beam, said at least one energetic beam impinges said
15 evaporant source and generates an evaporated vapor flux comprised of evaporant molecules; and

said primary carrier gas streams deflects at least a portion of at least one of said generated evaporated vapor flux by said primary carrier gas streams into said interior cavity of said substrate thereby coating at least a portion of interior of said
20 longitudinal section.

91. The apparatus of claim 90, further comprising:

a first nozzle, wherein said primary carrier gas streams is generated from said first nozzle and said at least one evaporant source is disposed in said first nozzle.
25

92. The apparatus of claim 90, further comprising:

a first nozzle, wherein said primary carrier gas streams is generated from said first nozzle and said at least one evaporant source is disposed in proximity to said first nozzle.
30

93. The apparatus of claim 90, wherein said energetic beam comprises at least one of electron beam source, laser source, heat source, ion bombardment source,

highly focused incoherent light source, microwave, radio frequency, EMF, or any energetic beam that break chemical bonds, or any combination thereof.

94. The apparatus of claim 90, wherein said coating apparatus comprises:
5 directed vapor deposition (DVD) apparatus, evaporation (thermal, RF, laser, or electron beam) apparatus, reactive evaporation apparatus, sputtering (DC, RF, microwave and/or magnetron) apparatus, reactive sputtering apparatus, electron beam physical vapor deposition (EF-PVD) apparatus, ion plasma deposition (IPD) apparatus, low pressure plasma spray (LPPS) apparatus, high velocity oxy-fuel
10 (HVOF) apparatus, vapor deposition apparatus, or cluster deposition apparatus.

95. The apparatus of claim 90, wherein said coating apparatus comprises a directed vapor deposition (DVD) apparatus.

15 96. The apparatus of claim 90, wherein said evaporated flux at least partially coats said portion of said interior of said longitudinal section on a non-line-of-sight region relative to said evaporant sources.

20 97. The apparatus of claim 90, wherein said evaporated flux at least partially coats said portion of said interior of said longitudinal section on a limited-line-of-sight region relative to said evaporant sources.

25 98. The apparatus of claim 90, wherein said evaporated flux at least partially coats said portion of said interior of said longitudinal section on a limited-line-of-sight region and a non-line-of-sight region relative to said evaporant sources.

99. The apparatus of claim 90, further comprises:
a deflector member; and
said deflector member secondarily deflecting said at least a portion of said
30 generated evaporated vapor flux that has been deflected into said interior cavity by said carrier gas streams thereby coating at least a portion of said longitudinal section, wherein said at least a portion of said longitudinal section defining a deposition zone.

100. The apparatus of claim 90, further comprises:

a secondary carrier gas streams comprised of gas molecules in said interior cavity of said substrate, and

5 said secondary carrier gas streams secondarily deflecting said at least a portion of said generated evaporated vapor flux that has been deflected into said interior cavity by said carrier gas streams thereby coating at least a portion of said longitudinal section, wherein said at least a portion of said longitudinal section defining a deposition zone.

101. The apparatus of claim 90, further comprises:

a baffle member; and

15 said baffle member secondarily deflecting said at least a portion of said generated evaporated vapor flux that has been deflected into said interior cavity by said carrier gas streams thereby coating at least a portion of said longitudinal section, wherein said at least a portion of said longitudinal section defining a deposition zone.

102. The apparatus of claim 90, further comprises:

a baffle member; and

20 said baffle member stagnating flow of said at least a portion of said generated evaporated vapor flux that has been deflected into said interior cavity by said carrier gas streams thereby coating at least a portion of said longitudinal section in proximity to said baffle.

103. The apparatus of claim 90, further comprising:

a first nozzle;

a second nozzle, wherein a second primary carrier gas streams is generated from said second nozzle and a second said evaporant source is disposed in said second nozzle;

30 impinging said second evaporant source with at least one electron energetic beam in said chamber to generate a second evaporated vapor flux comprised of evaporant molecules;

presenting a secondary carrier gas streams comprised of gas molecules to said chamber;

said secondary carrier gas streams deflecting at least a portion of at least one of said second generated evaporated vapor wherein said secondary deflection thereby
5 deflects said second carrier gas streams to the exterior of said substrate thereby coating at least a portion of exterior side of said longitudinal section.

104. The apparatus of claim 90, further comprising:

a primary nozzle, wherein said primary carrier gas streams is generated from
10 said primary nozzle; and

a secondary nozzle, wherein said secondary carrier gas streams is generated from said primary nozzle and said secondary nozzle is disposed in the interior cavity of said substrate.

15 105. An apparatus for applying at least one coating on a chamber comprising:

said chamber having a down stream pressure, P_c , with an operating range from about 10^{-4} to about 10^3 Torr;

at least one evaporant source presented to said chamber;

20 primary carrier gas streams comprised of gas molecules to said chamber,

at least one said evaporant source, said at least one evaporant source be impinged by at least one electron energetic beam in said chamber to generate an evaporated vapor flux comprised of evaporant molecules; and

said primary carrier gas streams deflecting at least a portion of at least one of
25 said generated evaporated vapor flux, wherein said evaporated flux at least partially coats a portion of said chamber.

106. The apparatus of claim 105, further comprising:

a magnetic field or electromagnetic field that manipulates said electronic
30 energetic beam in said chamber.

107. A substrate having at least one coating on a non-line of sight region and/or a limited line of sight region of the substrate, manufactured by the method of claim 1.

5 108. A substrate having at least one coating on a non-line of sight region and/or a limited line of sight region of the substrate, manufactured by the apparatus of claim 90.

10 109. The method of claim 1, wherein said longitudinal section comprises at least one of the following: planar surface, indented surface, convex surface, concave surface, ridged surface, corrugated surface, grooved surface, curved surface, multi-contoured surface, core comprised of truss units or truss-like units, core of textile layers or textile like layers, multi-channel surface, porous structure, or micro-porous structure, or any combination thereof.

15 110. The method of claim 1, wherein said interior cavity comprises at least one of the following: recess, aperture, port, duct, trough, bore, inlet, outlet, uptake, intake, hole, conduit, perforation, channel, groove, socket, seat, passage, pipe, indentation, pocket, sink, cell, slot, hollow-out-portion, sieve, orifice, flute, chamber,
20 well, tunnel, or channel, or any combination thereof.

25 111. The method of claim 11, wherein said tube comprises at least one of the following: hose, conduit, cable, stem, collet, flange, thimble, ring, ferrule, bushing, collar, nipple, or sleeve, or any combination thereof.